Essays on Modern Market Structure

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Certificate of Original Authorship

I, Marta Khomyn, declare that this thesis, titled "Essays on Modern Market Structure", is submitted in fulfilment of the requirements for the award of the degree of Doctor of Philosophy, in the Finance Discipline Group at UTS Business School at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

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Signature: Production Note: Signature removed prior to publication.

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To my parents.

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Abstract

Financial markets are different today from what they were two decades ago. This thesis examines recent issues in modern market structure: algorithmic liquidity provision, competition among exchange-traded funds (ETFs), and the shift of trading to the close of the trading day. The findings enhance our understanding of market structure changes resulting from technology, product innovation and market fragmentation.

Chapter 2 of this thesis examines how liquidity provision in fragmented markets affects order-to-trade ratios (OTTRs), a metric used by regulators to detect excessive quoting activity and market misconduct. The theoretical OTTR is determined by the trade-off between the market maker's information monitoring costs and picking-off risk (trading at stale prices). The theory explains why high OTTRs can result from legitimate market making in fragmented markets and are not necessarily a sign of misconduct. The empirical analysis supports the theoretical predictions. The empirical results suggest that recent growth in OTTRs is driven largely by fragmentation of trading across multiple venues and decreasing monitoring costs due to technological improvements. Calibration reveals that OTTRs on a typical day are within levels that are consistent with market-making activity, but occasionally spike beyond such levels. The results imply that regulatory measures designed to curb OTTRs (e.g., messaging taxes) are likely to harm liquidity provision in fragmented markets and create a non-level playing field for trading venues.

Chapter 3 asks how ETFs compete with one another and how their secondary market liquidity shapes this competition. It is puzzling that high-fee ETFs not only survive, but often accumulate greater assets under management (AUM), compared to low-fee ETFs tracking the same index. This chapter develops the equilibrium model of ETF competition, which resolves this puzzle. The main insight from the model is that secondary market liquidity of an ETF plays a key role in determining ETF fees and leads to liquidity clienteles. Greater liquidity attracts high-turnover investors, which sustain the high liquidity in a self-perpetuating cycle. The liquidity advantage allows the high-fee ETF to charge higher fees. The low-fee ETF serves low-turnover clientele, who are more sensitive to fees rather than liquidity. Liquidity clienteles explain the key features of ETF competition, including the first-mover advantage, the "winner-take-all" dynamics in trading volumes and the ability for incumbent ETFs to maintain higher fees. Empirical tests confirm the important role of liquidity clienteles and show that fee differentials for otherwise similar ETFs provide a novel measure of the value of liquidity to investors. Welfare analysis suggests that liquidity can be a source of monopolistic rents for ETF issuers.

Chapter 4 makes a methodological contribution by developing new measures of price discovery for sequential markets. The methodology accounts for the presence of noise in market prices, and hence allows us to study a new array of issues in modern market structure. Price discovery (the incorporation of new information into a security's price) is typically measured when a security trades simultaneously in multiple markets. The method proposed in this thesis extends the classic price discovery model of Hasbrouck (1995) to settings in which a security trades in consecutive phases (e.g., different market mechanisms or time zones) rather than in multiple markets. This approach allows information (efficient price innovations) to be separated from noise (microstructure frictions and liquidity) in each consecutive phase of trading. The Monte Carlo simulations confirm that the empirical estimation recovers correct Information Shares (IS), Noise Shares (NS), and Information-to-Noise ratios (IN). The method is computationally convenient, as it relies only on the output from vector autoregressive models (VARs). The proposed framework accounts for microstructure frictions in prices, and therefore produces more precise estimates of price informativeness compared to existing approaches.

Chapter 5 asks why so much trading has shifted towards the close of the trading day, and whether this tendency has made closing prices more informative. The empirical analysis shows that index investing, including ETFs, is by far the most important driver of trading on close. The price discovery results suggest that closing price informativeness has not improved with greater trading on close. The estimates rely on the novel price discovery methodology developed in the Chapter 4. The results reinforce policymakers' concerns that the increase in trading on close makes closing prices more vulnerable to dislocations.

Overall, this dissertation contributes to the academic and industry debate on the optimal market structure. The analysis of market-making OTTRs suggests that regulators should strike a balance between discouraging excessive quoting activity and encouraging competition between exchanges. The findings from ETF liquidity analysis imply that liquidity can be seen as a public good, with resulting "winner-take-all" externalities. The investigation of trading on close suggests that both market participants and regulators should recognize the potential disconnect between concentrated trading and price discovery. Although trading increasingly concentrates on close, price discovery still happens in continuous limit order books.

Working Papers and Presentations

Chapters 2–5 of this thesis have been concurrently developed as working papers, and presented at various academic conferences. The second working paper is joint work with Prof. Tālis Putniņš at University of Technology Sydney and Prof. Marius Zoican at University of Toronto Mississauga and Rotman School of Management. The list of working papers and conference presentations is below.

1. Khomyn, M. and Putniņš, T., 2017, *"Algos gone wild: Are order-to-trade ratios excessive?"*, Working paper, UTS Business School.
    - 2018 Financial Management Association (FMA) Annual Meeting. San Diego, USA.
    - 2018 Financial Management Association (FMA) Asia-Pacific Conference. Hong Kong, China.
    - 2017 Auckland Finance Meeting. Queenstown, New Zealand.
    - 2017 SIRCA Young Researchers Workshop. Melbourne, Australia.
2. Khomyn, M., Putniņš, T., & Zoican, M., 2019, *"The value of ETF liquidity"*, Working paper, UTS Business School.
    - 2019 Financial Intermediation Research Society (FIRS) Conference. Savannah, USA.
    - 2019 American Finance Association (AFA) Annual Meeting. Poster Session. Atlanta, USA.
    - 2018 Australasian Finance and Banking Conference. Sydney, Australia.
    - 2018 Financial Research Network (FIRN) Annual Conference. Brisbane, Australia.
    - 2018 Behavioural Finance and Capital Markets Conference. Melbourne, Australia.
3. Khomyn, M. and Putniņš, T., 2019, *"Measuring information and noise in sequential trading"*, Working paper, UTS Business School.
4. Khomyn, M. and Putniņš, T., 2019, *"The rise in trading on close: Drivers and effects on price formation"*, Working paper, UTS Business School.

- 2019 Australasian Finance and Banking Conference. Sydney, Australia.
- 2019 Financial Research Network (FIRN) Annual Conference. Byron Bay, Australia.
- 2019 Australian PhD Conference. Canberra, Australia.
- 2019 Behavioural Finance and Capital Markets Conference. Melbourne, Australia.
- 2019 International Accounting and Finance Doctoral Consortium. Milan, Italy.
- 2018 / 2019 Research Seminar Series, Baltic International Centre for Economic Policy Studies. Riga, Latvia.
- 2018 / 2019 Research Seminar Series, Kyiv School of Economics. Kyiv, Ukraine.
- 2018 / 2019 Research Seminar Series, Monash University. Melbourne, Australia.

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